No. 446M

Parr Instrument Company

Operating Instruction Manual for

4836

Temperature Controllers

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Related Instructions

The following Parr publications are also included to further your understanding of this instrument and its component parts:

No.	Description
230M	Safety Precautions to be observed when operating Pressure Reaction Equipment
201M	Limited Warranty

Customer Service

Questions concerning the installation or operation of this instrument can be answered by the Parr Customer Service Department:

309-762-7716
800-872-7720
Fax: 309-762-9453
www.parrinst.com
parr@parrinst.com

Preface

Scope

These instructions cover the installation and operation of the Parr Model 4836 Temperature Controller as used with Parr Laboratory Reactors and Pressure Vessels. They cover the basic functions for this controller and describe the several optional control modules which can be added to this expandable unit. The users should study the instructions carefully before using this controller so that they will fully understand the capabilities of this equipment and the safety precautions to be observed in its operation.

Applications

Each 4836 Controller consists of a packaged temperature control unit completely wired and assembled with appropriate power and safety relays, switches, and pilot lights. These units are designed specifically for use with Parr reactors and pressure vessels and are to be used only with Parr equipment. They are wired for plug-in attachment to current Parr models, but they can be modified for use with older Parr equipment if changes are required. Four additional control and display modules are available for use with these controllers. These are described later in this manual. Any one of these optional modules can be installed in a 4836 Controller. Controllers furnished with Parr reactors equipped with variable speed, DC motors have a motor switch and a speed control knob on the front panel. Controllers to be used an air motor, or with no motor do not have a speed control knob.

Electrical Ratings

Before connecting any 4836 Controller to a reactor or heating device, the user must be sure that the line, load, and other characteristics of the installation do not exceed the following limits:

Voltage. The line voltage should not differ from the rated voltage shown on the nameplate by more than 10 percent.

Frequency. This controller can be operated from either a 50 or 60 Hertz power supply without affecting its operation or calibration.

Current. The solid state switching relay in these controllers will handle non-inductive loads up to 25 amps maximum, but loads drawn from the **PARR HEATING ONLY** outlet on the back panel must not exceed 15 amperes. All supply and accessory wiring to this controller shall have a minimum insulation rating of 105°C, type SJT or better.

Inductive Loads. Inductive loads must be limited to 750 watts (1 hp) at 115 volts, or to 1100 watts (1-1/2 hp) at 230 volts. Do not connect these controllers to the primary (input) side of an auto-transformer (Variac, Powerstat, or the like). The heavy inductive load on the primary side of such transformers will destroy the relay. The secondary (output) side of an auto-transformer can be carried through the relay if this circuit is isolated from the controller. A separate, full-voltage connection must then be made to operate the temperature controller and to actuate the relay.

Thermocouple. Unless otherwise specified, all 4836 Controllers operate with a Type J (iron constantan) thermocouple. The total resistance of the thermocouple and the lead wires should not exceed 20 ohms. If the resistance of the thermocouple circuit is higher, it will reduce the sensitivity of the control system.

Connections

CONNECTIONS TO A PARR REACTOR

Set the controller near the reactor on a sturdy bench or table where there is convenient access to an electrical outlet capable of carrying up to 15 amperes. Leave a space of at least twelve inches between the controller and the reactor so that the controller will not be unduly affected by radiant heat from the reactor. This controller is intended to be used indoors at an ambient temperature between 10°C and 30°C with a relative humidity of less than 80 percent.

Labeled plug-in sockets are provided on the rear panel for the reactor heater cord and for a Type J thermocouple. There is also a special polarized socket for the stirrer drive motor. An additional socket labeled **PARR COOLING ONLY**, is energized at full line voltage whenever cooling is called for by the controller. This circuit provides a means for activating an optional cooling system by using a solenoid valve to control the flow of cold water through an internal cooling coil of the reactor. Appropriate connectors are also provided for a pressure sensor, for a high limit Type J thermocouple, and for an optical tachometer when these options are specified. If the connectors provided on the controller are not compatible with earlier Parr equipment, conversion kits can be supplied to make the necessary modifications.

Instructions For 4836 Controllers

Instructions for 4836 Controllers

The Model 4836 Controllers have a micro-processor based control module that provides full three term control with adjustable tuning parameters. Detailed operating instructions are provided in the manufacturer's User's Manual which is furnished as a supplement to these instructions. Users should study these instructions carefully to ensure that they take full advantage of the sophisticated capabilities provided by these control modules. That portion of the instructions which deals with installation can be overlooked since all of the described steps and connections were accomplished when the module was installed in the Parr chassis.

To facilitate start up with reasonably good PID control parameters for both heating and cooling all 4836 Controllers are programmed at the factory with the following settings:

For heating:

Cycle time	**5 seconds**
Proportional band	**25 °C**
Reset	**10 (minutes/reset)**
Rate	**0 (minutes)**

For cooling:

Cycle time	**5 seconds**
Proportional band	**25 °C**

Output 1 on these controllers drives the heater. Output 2 can be used to activate a cooling system. Control parameters can be set independently for each of these outputs.

Model 4836 specifications

Input thermocouple	Type J
Operating range	0 to 750 °C
Readout resolution	1 °C
Setpoint resolution	1 °C
System accuracy	+/-2 °C
Control action	Three term PID control plus limit control
Control output 1	15 amp @ 115V, 15 amp @ 230V
Control output 2	0.5 amp
Operating voltages	115 and 230 VAC
Maximum switching load	15 amp @ 115 VAC 15 amp @ 230 VAC

126 Programmable ramp and soak segments
RS232 Communications

Switches and Indicators

Switches and Indicators

There are three illuminated switches on the front panel, along with a speed control potentiometer.

The instrument switch controls power to the temperature control module and to the cooling circuit mentioned above. It also energizes any optional display or control modules installed in the controller.

Main Power Switch (230 Volt only)
The back panel of the 230 Volt models contains a power switch. This switch will cut off power to both lines of a 230 volt system.

Polarity Indicator Light (230 Volt only)
The light will illuminate when the unit is properly plugged in. In countries with un-polarized electrical plugs, the polarity indicator light will only illuminate when the plug is correctly inserted into its socket.

The heater switch is a manual, two position, illuminated switch which controls whether or not power is sent to the heater. Both the instrument switch and the heater switch must be turned on to activate the heater because power for the heater is supplied through a solid state relay controlled by the temperature control module. The light in the heater switch will glow only when current is flowing to the heater. Turning off the instrument switch will also turn off the heater.

The motor controls consist of an on-off switch and a potentiometer to control the speed of the DC motor furnished on current Parr stirred reactors. The speed control knob should be turned down to a minimum setting before turning on the motor switch to minimize electrical surges within the speed control unit. There is no speed control knob on any Series 4836 Controller furnished with a Parr reactor equipped with an air motor. These controllers will have only an on-off motor switch. The speed control function will also be omitted from any controller furnished for use with an earlier Parr reactor equipped with a variable speed motor having its own, free-standing speed control unit.

The high limit indicator light will glow if the controller receives an indication from any of its sensors that a high temperature or pressure limit has been reached and the lockout relay has opened. When this light comes on, the user must find the source of the problem, correct it, and then manually reset the system using the high limit reset button on the back of the controller.

Switches and Indicators
(Continued)

PROTECTIVE FUSES AND RELAYS

An instrument fuse is mounted on the back panel. This is a Type 3AG, 15 amp fuse, intended to protect the temperature control module, any installed display modules and the connected heater from short or overloads in the circuitry.

Protection for 0-90 volt motors is provided by a circuit breaker mounted on the back panel. This is a resetable breaker designed to protect the motor if it becomes overloaded. The breaker will have a rating selected to match the motor on the apparatus.

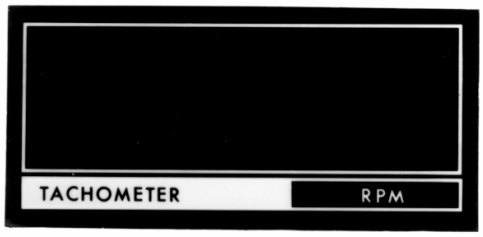
Protection for 0-180 volt motors is provided by a lighted fuse holder mounted on the back panel. A light will come on if the motor becomes overloaded and the fuse burns out. The fuse rating will be selected to match the motor on the apparatus.

Thermocouple burnout protection is included in each of these controllers. If the thermocouple should burn out, or if there is a break in the thermocouple circuit, power to the heater will be shut-off. In most cases this will cause the controller to show a maximum temperature reading. A similar high reading will be displayed if the controller is turned on without an attached thermocouple. The thermocouple break must be corrected in order to activate the system.

Access to the Controller Cabinet

To open the controller cabinet, unplug the power cord and remove the two screws in the upper corners of the back panel. This will allow the hinged top and front panel to swing forward, providing full access to all internal components.

Digital RPM Display Module



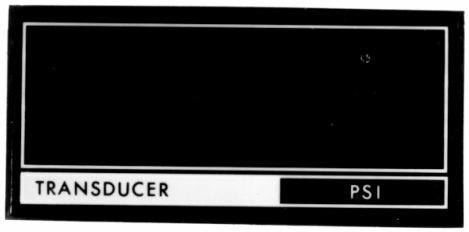
Digital RPM Display Module

This optional feature can be included in any Series 4840 Controller to provide a means for continuously monitoring the stirring speed in a Parr reactor. It consists of a digital readout mounted in the controller cabinet connected to an optical sensor installed in the overarm drive on the reactor. The connecting cable has a microphone plug which fits into a marked socket on the back panel of the controller. The digital display will show the stirring speed over a range from 0 to 2000 rpm with a 1 rpm resolution and +/-10 rpm accuracy.

Parts for Optical Tachometer Module (TDM)

A1001E	Optical sensor for cart reactor
A1001E2	Optical Sensor for bench top reactor
A1001E3	Optical Sensor for compact reactors
1564HC	Optical wheel for cart and bench top reactors
3056HC	Optical wheel for compact reactors
A1005EEB/EE	Tachometer display
A1005E2EB/EE	Tachometer display w/4-20ma analog out
A1005E3EB/EE	Tachometer display w/0-5vdc analog out
A1005E4EB/EE	Tachometer display w/0-10vdc analog out
A1002E	Cable Assembly, 3 feet
A1002E2	Cable Assembly, 6 feet
A1002E3	Cable Assembly, 10 feet
A1002E4	Cable Assembly, 20 feet

Digital Pressure Display



Digital Pressure Display

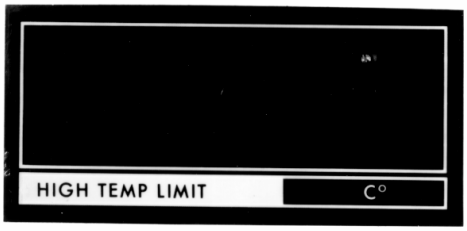
This module provides a digital readout for continuously monitoring the pressure within the reactor. Pressure is displayed with 1 psi resolution and 10 psi accuracy on a digital readout, normally calibrated from 0 to 2000 psig.

The signal for the pressure display is generated by a transducer in a stainless steel housing mounted on the reactor near the Bourdon tube pressure gage. The transducer must not be heated above 120°C. A water cooling sleeve attached to the transducer fitting can be used to keep the transducer below this limit when operating the reactor in a higher range. For applications involving reactants corrosive to stainless steel, the stainless steel transducer fitting can be replaced with an isolator which will keep the reactants away from the transducer. Users should consult with the Parr engineering staff regarding possible corrosion protection arrangements. When ordering a pressure display module separately or installed in any Series 4836 Controller, always specify the reactor in which the transducer will be installed so that the proper mounting hardware can be furnished.

Parts for Pressure Transducer Module

A818EEB/EE	Pressure display, 2000 psi
A818E4EB/EE	Pressure display, 20,000 psi
A818E6EB/EE	Pressure display, 2000 psi, 5 vdc analog
A818E7EB/EE	Pressure display, 2000 psi, 10 vdc analog
A818E8EB/EE	Pressure display, 2000 psi, 4-20 ma analog
A818E9EB/EE	Pressure display, 345 bar
A818E10EB/EE	Pressure display, 20,000 psi, 5 vdc analog
A818E11EB/EE	Pressure display, 172 bar
A818E12EB/EE	Pressure display, 172 bar, 5 vdc analog
A818E13EB/EE	Pressure display, 172 bar, 4-20 ma analog
A818E14EB/EE	Pressure display, 345 bar, 5 vdc analog
A818E15EB/EE	Pressure display, 5000 psi, 10 vdc analog
A818E17EB/EE	Pressure display, 5000 psi, 4-20 ma analog
A821E	Pressure harness, external, 5 ft
A821E3	Pressure harness, external, 10 ft
A821E3	Pressure harness, external 20 ft
825HC	Snap ring for cooling sleeve
827HC	O-ring for cooling sleeve
828HC	Cooling sleeve
A836EP25	Pressure transducer, 2500 psi
A836EP50	Pressure transducer, 5000 psi
1394HC	Adapter, body

Digital Temperature Display



Digital Temperature Display

This module provides an independent temperature display. It has its own thermocouple, digital display and wiring, When used with a Parr Mini or Micro Reactor, this module requires a dual thermocouple consisting of two thermocouples sealed within a single sheath and installed in the single thermocouple fitting in the reactor head. In all other Parr reactors this module operates from a second thermocouple inserted into the thermowell together with the basic control thermocouple. When ordering this option separately or installed in a Series 4836 Controller, always specify the reactor with which it will be used so that a thermocouple of the proper style and length can be furnished.

Parts for Temperature Module

1129E	Thermocouple socket
A819EEB/EE	Temperature display
A819E3EB/EE	Temperature display, 5 vdc analog
A819E4EB/EE	Temperature display, 4-20 ma analog
A819E5EB/EE	Temperature display, 10 vdc analog
A470E2	Thermocouple extension wire, 5 ft
A470E4	Thermocouple extension wire, 10 ft
A470E5	Thermocouple extension wire, 20 ft
A460E-	Dual element thermocouple series
A472E-	Single element thermocouple series

Digital Ammeter Display Module

Digital Ammeter Display Module

This module provides a means for continuously monitoring the current being drawn by the stirrer motor. Since the motor speed control will provide a constant stirring speed at any given setting, changes in the current drawn by the motor will correspond to changes in the viscosity of the reactants in the vessel. This will be a useful option for users who want to monitor the progress of a polymerization reaction in which there is a viscosity change as the reaction proceeds.

Parts For Ammeter Display Module

A1191EEB/EE	Ammeter, 1/8 hp motor
A1191E2EB/EE	Ammeter, 1/4, 1/2, 3/4 hp motors
A1191E3EB/EE	Ammeter, 1/8 hp motor, 5 vdc analog
A1191E4EB/EE	Ammeter, 1/4, 1/2, 3/4 hp motors, 5 vdc analog
A1191E5EB/EE	Ammeter, 1/4, 1/2, 3/4 hp motors, 4-20 ma analog
1193E	Shunt resistor, 0.1 ohm

Solenoid Valve Module

Solenoid Valve Module

This module provides a solenoid valve, a metering valve and all parts needed to assemble an automatic system for controlling the flow of coolant through a cooling coil in any reactor. It usually is installed in a cold water line with a flow connection to the cooling coil and an electrical connection to the cooling socket on the back of the temperature controller. Coolant will then be admitted to the coil whenever cooling is called for by the controller, thereby minimizing any temperature overshoot. This system is particularly advantageous when holding fixed temperatures below 150°C or for controlling exothermic reactions. Compressed air can be used as a coolant if the amount of heat to be removed is not large.

Speed Control and Adjustments

Motor Speed Control

4836 Controllers are equipped with a solid state speed control module for use with the variable speed DC motors installed on Parr stirred reactors. The module itself (approximately 4 inches square) is mounted inside the chassis on the bottom plate. A motor switch and a speed adjustment potentiometer are mounted on the front panel. A transient protector fuse is included with each module to prevent damage to the power bridge from voltage spikes in the AC line. Each module also requires a resistor matched to the horsepower of the motor with which it will be used, as listed in the table below:

Motor Rating	Motor Voltage	Resistor Required	Parr Number
1/17HP	90 VDC	0.25 ohm	876E6
1/8HP	90 VDC	0.18 ohm	876E4
1/4HP	90 VDC	0.05 ohm	876E
1/4HP	180 VDC	0.10 ohm	876E3
1/2HP	90 VDC	0.025 ohm	876E2
1/2HP	180 VDC	0.05 ohm	876E
3/4HP	180 VDC	0.035 ohm	876E5

Controllers furnished as part of a complete Parr stirred reactor system will have the proper resistor installed at the factory. Any controller sold separately will require a motor specification so that the proper resistor may be provided.

Always turn the speed control knob fully counterclockwise to the off position before turning on the motor switch, then advance the knob clockwise slowly to develop the desired speed. Do not overload the motor. Any high speed or high viscosity load which trips the circuit breaker is too heavy. Use the reset button on the rear panel to restart the motor and reduce the speed to avoid overloading.

Speed Control and Adjustments
(Continued)

Adjustments

There are five trimpots in the speed control module that can be used to adjust the performance of the motor. These are set at the factory for optimum performance and should not be changed unless customized settings are required to match a particular set of operating conditions. The instructions below should be followed carefully if these controls are to be readjusted.

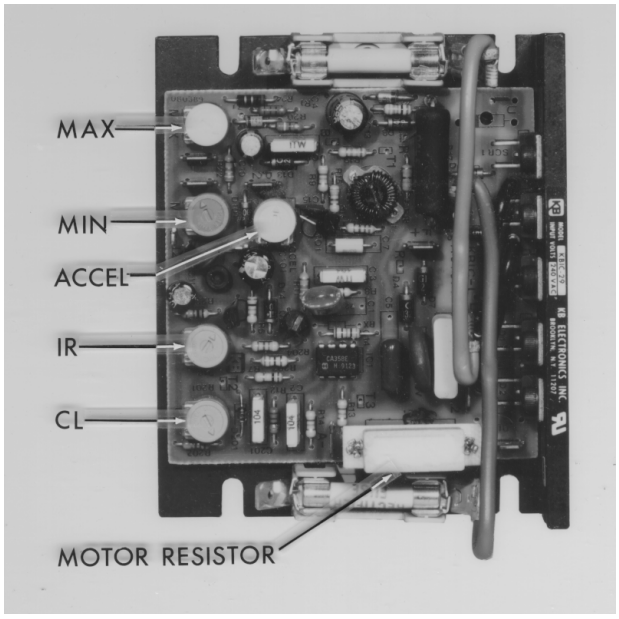
The CL, current limiting/torque adjustment (with an orange knob) is set at the factory to 1.5 times the motor rating. It is intended to protect both the module and the motor against overloads and heavy surge currents during startup. It can also serve as a torque limiting device by reducing the maximum power output of the system.

The IR, compensation adjustment (with an orange knob) is used to improve motor control under varying load conditions. If the loads do not fluctuate, this control can remain at approximately one-fourth of full setting. But if the motor speed drops more than 2% under load, this adjustment should be increased. If it is set too high, the motor speed will fluctuate in a cyclical manner.

The MAX, maximum speed adjustment (with a white knob) controls the maximum speed of the motor. To increase the motor speed, turn the control knob on the front panel to its maximum setting, then use the MAX trimpot to raise the speed to the desired level. Note, however, that the motor may become unstable if the speed is raised above the motor's rated rpm.

The MIN, minimum speed adjustment (with a red knob) can be used to raise the minimum motor speed above zero. To change this setting, turn the control knob on the front panel to its minimum setting, then adjust the MIN trimpot to obtain the desired minimum speed. This adjustment will also affect the maximum setting, making it necessary to adjust both MAX and MIN trimpots to obtain the desired spread.

The ACCEL, acceleration adjustment (with a yellow knob) is normally set to provide controlled acceleration from zero to full speed in 2 seconds. It can be adjusted to higher or lower acceleration times anywhere between 0.5 and 4 seconds, but changing this setting will affect the MAX speed and the IR compensation which will have to be readjusted. If the acceleration time is reduced to 0.5 seconds (6 o'clock trimpot position), increase the IR trimpot one quarter turn clockwise and decrease the MAX trimpot one fifth turn counterclockwise. If the acceleration time is increased to the maximum time of 4 seconds (full rotation), the IR trimpot must be decreased and the MAX increased in the same rotation amounts mentioned above.



Cleaning and Maintenance

Periodic cleaning may be performed on the exterior surfaces of the controller with a damp cloth. All power should be disconnected when cleaning Series 4840 Controller. The replacement of protective fuses for the heater and motor circuits are the only internal maintenance procedures that should be performed by the user. There are no user serviceable parts inside the Series 4840 Controller. Advanced troubleshooting instructions can be obtained by calling the Parr Instrument Company to determine which parts may need to be replaced or serviced.

Parts for all Series 4836 Controllers

139E8	Fuse, So-blo,2.5 amp, 1/2hp 180VDC Motor
139E23	Fuse, fast/act, 15 Amp
139E19	Fuse, slo-blo, 1.5 Amp, 1/4 hp, 180 VDC Motor
1129E	Thermocouple socket
A410E8EB	Speed Control Module, 120 VAC/90VDC, 1/4 hp
A410E8EE	Speed Control Module, 230 VAC/90VDC, 1/4 hp
A410E9EB	Speed Control Module, 120 VAC/90VDC, 1/2 hp
A410E8EE	Speed Control Module, 230 VAC/90VDC, 1/2 hp
A1252EEE	Speed Control Module, 230 VAC/180VDC, 1/2 hp
A1252E2EE	Speed Control Module, 230 VAC/180VDC, 1/4 hp
585E2EE	Switch, inst/motor
1119E	Relay, 25 amp
801E	Circuit breaker, 0.5 amp (1/12hp, 90VDC motor)
801E2	Circuit breaker, 2.5 amp (1/4hp, 90VDC motor)
801E3	Circuit breaker, 1.5 amp, (1/8hp, 90VDC motor)
801E4	Circuit breaker, 5 amp, (1/2hp, 90VDC motor)
A1845E	Temperature control module, 4836
876E	Resistor, 0.05 ohm, 1/4hp 90VDC,1/2hp 180VDC motors
876E2	Resistor, 0.025 ohm, 1/2hp 90VDC motor
876E3	Resistor, 0.10 ohm, 1/4hp 180VDC motor
876E4	Resistor, 0.18 ohm, 1/8hp, 90 VDC motor
876E5	Resistor, 0.035 ohm, 3/4hp 180VDC motor
876E6	Resistor, 0.25 ohm, 1/17hp 90VDC motor

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